



Office of
Transportation Technologies

The Advanced Natural Gas Vehicle

An automotive breakthrough that promises to bring America the benefits of a domestically abundant, cleaner fuel

Imagine if the millions of passenger cars on our roads all ran on a domestically abundant fuel that fully benefited the American economy with every fill-up, while also contributing to cleaner air by emitting only minimal amounts of the carbon dioxide, nitrogen oxide (NO_x) and other pollutants that make gasoline-fueled traffic affect our health.

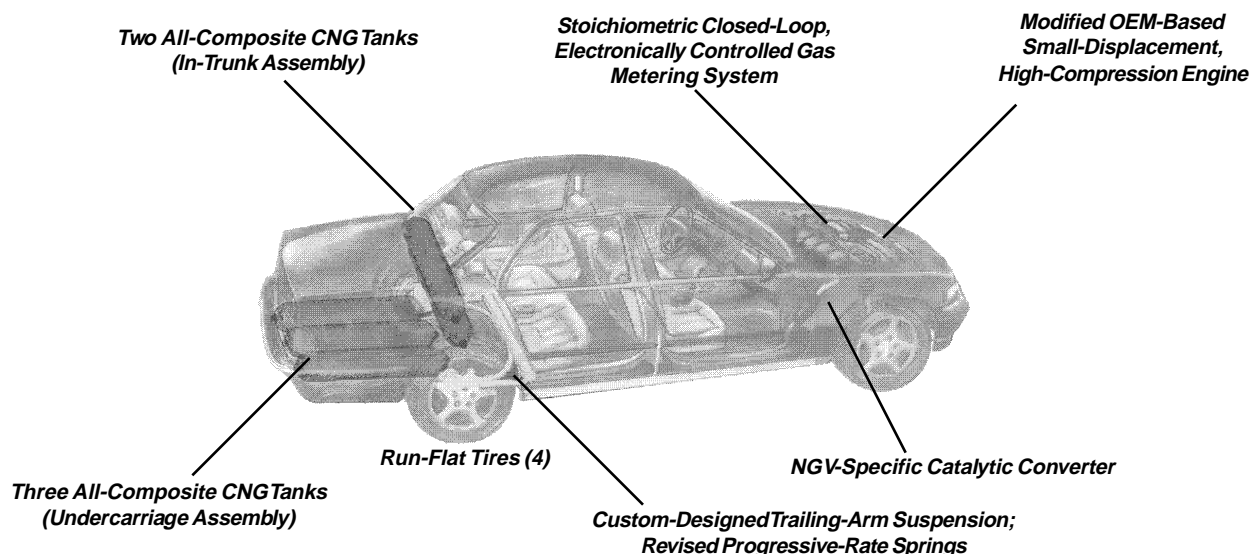
Over the past decade, thousands of American drivers have taken a step toward this vision by opting for alternative-fuel passenger cars such as those running on natural gas, but these pioneers have needed to sacrifice conveniences including driving range and cargo space—sacrifices deemed too great for the vast majority of consumers. Until these problems are addressed and a mass-producible, consumer-acceptable natural gas vehicle (NGV) option can be offered in the nation's auto showrooms, the substantial economic, energy security, and environmental benefits of widespread use of NGVs will be out of our reach.

DOE's Office of Transportation Technologies (OTT) and its cost- and resource-sharing private-sector partners

have met this challenge head on. OTT recently unveiled a major breakthrough in automotive design—an innovative NGV concept offering a range nearly double that of prior models and within 15 percent of comparable gasoline models, and a reclamation of most of the trunk space lost in current retrofit designs. With ongoing testing of its proof-of-concept "Advanced Natural Gas Vehicle" (ANGV) demonstrating success in every way, the development team is finalizing its plans to build a second-generation model that will bring the ANGV concept even closer to a practical, mass-producible vehicle. And, with OTT's help, they have brought a new partner on board, Chrysler Corporation, which will provide hardware and technical assistance to the ongoing R&D effort.

Leading a Complete Rethink of the NGV Concept. According to team members, building a better NGV required rethinking the vehicle from the ground up, rather than thinking of how to best retrofit an existing gasoline vehicle. Research first began on building an

Advanced Natural Gas Vehicle Artist's Concept



engine optimized to make the most effective use of the combustion properties of natural gas. Toward this end, the team assembled a high-compression, small-displacement replacement engine that increased fuel efficiency, effectively increasing vehicle range. Their second challenge was integrating the natural gas storage system on the vehicle so as to provide maximum fuel capacity with minimal encroachment on user space. Eschewing the retrofit approach of putting tanks in the trunk, the team strategically restructured the underchassis and rear suspension. Their third breakthrough was the adaptation of the “run-flat tire” technology used on racing vehicles. By replacing standard tires with ones capable of running for miles without air, if a flat occurs, they reclaimed the space usually taken up by the spare and jack. Through this three-part systems approach, the development team was able to deliver both longer range and greater user convenience in a vehicle that looks and performs nearly identically to a conventional gasoline vehicle.

Next Step—the Second Generation. Since its unveiling, the proof-of-concept ANGV has been driven in fleet service, and has demonstrated its ability to meet both stringent Ultra Low Emission Vehicle (ULEV) emissions standards and consumer demands for performance, convenience, and a comfortable highway/city-driving range. The team is now working to advance the technology of the ANGV concept to make it even more practical from the point of view of auto manufacturers.


One dramatic improvement to be included in the three second-generation vehicles under development is an Integrated Storage System (ISS), which replaces the “strapped-together-tanks approach” to natural gas storage with a concept that has the appearance of a gasoline tank, while reducing the cost and weight of the compressed natural gas (CNG) storage system. The team is also planning to include the type of multi-point gaseous fuel injection system currently favored by Detroit. Other upgrades to the second-generation ANGV include the optimized conversion of a “stock” gasoline engine to natural gas and the reclamation of even more trunk space.

A Concept Offering Tremendous Benefits to the U.S. If the ANGV team can meet its goal of creating a mass-producible NGV, the resulting displacement of foreign petroleum in favor of a cleaner, domestically

abundant fuel will help American free itself from foreign energy dependence, improving national security and stability and reclaiming billions of lost trade dollars. It will also help create thousands of new jobs and improve the quality of our air.

The core project team, led by OTT and The Johns Hopkins Applied Physics Laboratory (APL), along with Lincoln Composites Co., developers of the ISS; engine experts Chesapeake Automotive Enterprises; Goodyear Tire, which adapted their run-flat technology for the effort; and several gas industry organizations, all share a vision of this being the future for the American transportation sector. And they’re not alone in championing the technology—Chrysler Corporation thought enough of the project to contribute technical support and hardware for the mid-size Plymouth Breeze, around which the second-generation ANGV will be built, and has shown interest in the ISS for other future activities. In addition, *Popular Science Magazine* honored the ANGV with its “Best of What’s New Award,” recognizing it as one of the 100 most significant achievements of 1995, and the Society of Automotive Engineers honored it as a breakthrough in alternative fuel research.

“For all its potential, the ANGV project wouldn’t have been in existence without OTT. They are pivotal to the whole thing,” notes APL Project Manager John Wozniak. “Without their support, encouragement, funding, and success in getting the OEMs and gas industry cost-sharing participants like the Gas Research Institute and Southern California Gas involved, this effort would be nowhere today.”

 **Transportation
Technologies**

For more information, please contact:
U.S. Department of Energy
Office of Transportation Technologies
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-8014